Claims

1. A fluid dispensing system, comprising:

a photon source disposed on a moveable carriage; and

a fluid ejector array having a plurality of fluid ejection elements disposed on a substrate, each fluid ejection element having:

a fluid ejector, and

a photodetector electrically coupled to said fluid ejector, wherein moving said photon source over at least a portion of said fluid ejector array, selectively illuminates said photodetectors, thereby selectively activating said fluid ejectors coupled to said illuminated photodetectors.

2. The fluid dispensing system in accordance with claim 1, further comprising a drop firing controller coupled to said photon source and to said fluid ejector array.

3. The fluid dispensing system in accordance with claim 2, further comprising:

a memory device coupled to said drop firing controller; and

a position controller coupled to said memory device.

4. The fluid dispensing system in accordance with claim 3, further comprising:

a medium advancing motor advancing a fluid receiving medium; and

a carriage motor moving said photon source, said medium advancing motor and said carriage motor coupled to said position controller, wherein said fluid ejector array dispenses a fluid on at least a portion of said fluid receiving medium.

5. The fluid dispensing system in accordance with claim 4, wherein said position controller and said drop-firing controller dispense said fluid in a two dimensional array on said fluid receiving medium.

6. The fluid dispensing system in accordance with claim 1, wherein said moveable carriage further comprises a reciprocating carriage.

7. The fluid dispensing system in accordance with claim 6, wherein said translationally reciprocating carriage further comprises a linearly translated reciprocating carriage.

8. The fluid dispensing system in accordance with claim 1, wherein said moveable carriage further comprises a translationally moveable carriage.

9. The fluid dispensing system in accordance with claim 1, wherein said moveable carriage further comprises a two dimensionally moveable carriage.

10. The fluid dispensing system in accordance with claim 1, wherein said fluid ejector further comprises an energy converting element, wherein activation of said energy converting element ejects essentially a drop of said fluid.

11. The fluid dispensing system in accordance with claim 10, wherein the volume of said fluid, of essentially said drop, is in the range of from about 5 femto-liters to about 750 pico-liters.

12. The fluid dispensing system in accordance with claim 10, wherein said energy converting element further comprises a thermal resistor element.

13. The fluid dispensing system in accordance with claim 10, wherein said energy converting element further comprises a piezoelectric element.

14. The fluid dispensing system in accordance with claim 1, wherein said photon source emits photons in a predetermined wavelength region and said substrate has sufficient transmittance in said wavelength region providing a signal to noise ratio of at least two to one.

15. The fluid dispensing system in accordance with claim 1, further comprising at least one nozzle disposed over said substrate in fluid communication with said fluid ejector.

16. The fluid dispensing system in accordance with claim 15, further comprising:

a chamber layer selectively disposed over said substrate, said chamber layer defining side walls of an ejection chamber; and

a nozzle layer disposed over said chamber layer, said nozzle layer having said at least one nozzle fluidically coupled to a fluid ejector of said array of fluid ejectors.

17. The fluid dispensing system in accordance with claim 1, further comprising one or more fluid channels fluidically coupled to said fluid ejector.

18. The fluid dispensing system in accordance with claim 17, wherein said one or more fluid channels are formed in said substrate.

19. The fluid dispensing system in accordance with claim 18, wherein said one or more fluid channels are formed through said substrate.

20. The fluid dispensing system in accordance with claim 17, further comprising a fluid manifold fluidically coupled to said one or more fluid channels.

21. The fluid dispensing system in accordance with claim 1, wherein said substrate further comprises two opposing major surfaces, a first major

surface and a second major surface, wherein said fluid ejector is disposed over said first major surface and said photodetector is disposed over said second major surface, and an electrical through connect disposed in said substrate electrically couples said photodetector and said fluid ejector.

22. The fluid dispensing system in accordance with claim 1, wherein said substrate further comprises an inorganic or organic material.

23. The fluid dispensing system in accordance with claim 1, further comprising an optical trigger circuit electrically coupled to said photodetector.

24. The fluid dispensing system in accordance with claim 23, wherein said optical trigger circuit further comprises at least one amplifying circuit.

25. The fluid dispensing system in accordance with claim 23, wherein said optical trigger circuit further comprises:

a memory device electrically coupled to said photodetector; and

a voltage level shifter electrically coupled to said memory device and to said fluid ejector.

26. The fluid dispensing system in accordance with claim 1, further comprising a focusing element disposed between said photon source and said photodetector.

27. The fluid dispensing system in accordance with claim 26, wherein said focusing element further comprises a photon beam deviator, deviating said photons in a predetermined direction.

28. The fluid dispensing system in accordance with claim 27, wherein said photon beam deviator further comprises a prism and a lens.

29. The fluid dispensing system in accordance with claim 28, wherein said prism and said lens are molded into a unitary piece.

30. The fluid dispensing system in accordance with claim 26, wherein said focusing element further comprises a rod lens having a graded refractive index profile.

31. The fluid dispensing system in accordance with claim 30, wherein said rod lens further comprises a lens axis, wherein said graded refractive index decreases quadratically from said lens axis.

32. The fluid dispensing system in accordance with claim 26, wherein said focusing element further comprises a photon beam collimator having a body including a body material having an index of refraction of n1, said photon beam collimator further includes an optical waveguide including a waveguide material having an index of refraction of n2, wherein said body material forms an interface with said waveguide material, and n2 is greater than n1.

33. The fluid dispensing system in accordance with claim 1, wherein said photodetector further comprises a photodiode.

34. The fluid dispensing system in accordance with claim 1, wherein said photodetector further comprises a phototransistor.

35. The fluid dispensing system accordance with claim 1, further comprising a charge storage capacitor electrically connected to said photodetector.

36. The fluid dispensing system in accordance with claim 1, wherein said photon source further comprises a carbon nanotube photon emitter.

37. The fluid dispensing system in accordance with claim 1, wherein

said photon source emits in a predetermined portion of the electromagnetic spectrum from about the ultraviolet region to about the infrared region.

38. The fluid dispensing system in accordance with claim 1, wherein said photon source further comprises a photonic crystal.

39. The fluid dispensing system in accordance with claim 1, wherein said photon source further comprises a light emitting diode.

40. The fluid dispensing system in accordance with claim 1, wherein said photon source further comprises an electroluminescent source.

41. The fluid dispensing system in accordance with claim 40, wherein said electroluminescent source further comprises an electroluminescent material.

42. The fluid dispensing system in accordance with claim 41, wherein said electroluminescent material further comprises an organic electrofluorescent material or an organic electrophosphorescent material.

43. The fluid dispensing system in accordance with claim 41, wherein said electroluminescent material further an inorganic electrofluorescent material or an inorganic electrophosphorescent material.

44. The fluid dispensing system in accordance with claim 41, wherein said electroluminescent material is selected from the group consisting of zinc sulfide, zinc selenide, zinc telluride, manganese sulfide, cadmium telluride, cadmium sulfide, cadmium selenide, and mixtures thereof.

45. The fluid dispensing system in accordance with claim 41, wherein said electroluminescent material is selected from the group consisting of aluminum quinolate, 10-azoanthracene, 3,6 acridinediamine, carbazole, substituted carbazoles, and mixtures thereof.

46. The fluid dispensing system in accordance with claim 40, wherein said electroluminescent source further comprises:

a photon source substrate;

a first electrode layer disposed on said photon source substrate;

an electroluminescent layer disposed over said first electrode layer; and

a second electrode layer disposed over said electroluminescent layer.

47. The fluid dispensing system in accordance with claim 46, further comprising:

a first dielectric layer disposed between said first electrode layer and said electroluminescent layer; and

a second dielectric layer disposed between said electroluminescent layer and said second electrode layer.

48. The fluid dispensing system accordance with claim 1, wherein said fluid ejector array further comprises an m x n array of fluid ejectors electrically coupled to an m x n array of photodetectors, and said photon source further comprises a j x k array of photon emitters, wherein j is less than or equal to m, and wherein k is less than or equal to n.

49. The fluid dispensing system accordance with claim 48, wherein j is less than m and m is an integral multiple of j, and wherein k is less than n and n is an integral multiple of k.

50. The fluid dispensing system in accordance with claim 1, wherein said fluid ejector actuator further comprises an m x n array of fluid ejectors electrically coupled to an m x n array of photodetectors, and said photon source

further comprises a j x n array of photon sources, wherein j is less than m and m is an integral multiple of j.

51. The fluid dispensing system in accordance with claim 1, wherein said fluid ejector further comprises an electromechanical or thermomechanical fluid ejector.

52. The fluid dispensing system in accordance with claim 1, further comprising a fluid selected from the group consisting of inks, adhesives, lubricants, chemical reagents, biological reagents, and mixtures thereof.

53. A fluid dispensing system, comprising:

means for emitting photons disposed on a reciprocating carriage;

a fluid ejector array having:

a plurality of means for generating an energy impulse to a fluid, disposed on a substrate, and

a plurality of means for detecting photons electrically coupled to said means for generating an energy impulse, wherein translationally scanning said carriage across said fluid ejector array said means for emitting photons photonically couplable to each of said means for detecting photons, wherein photons emitted from said means for emitting photons selectively interacts with said plurality of means for detecting photons generating activation signals, thereby selectively activating said means for generating an energy impulse ejecting a fluid away from said fluid ejector array.

54. A fluid dispensing system, comprising:

means for emitting photons disposed on a moveable carriage; and

a fluid ejector array having a plurality of fluid ejection elements disposed on a substrate, each fluid ejection element having:

means for generating an energy impulse to a fluid, disposed on said substrate

means for detecting photons electrically coupled to said means for generating an energy impulse, wherein moving said carriage over said fluid ejector array said means for emitting photons selectively illuminating said means for detecting photons, thereby selectively activating said means for generating an energy impulse coupled to said illuminated means for detecting photons ejecting said fluid away from said fluid ejector array.

55. The fluid dispensing system in accordance with claim 54, further comprising means for selectively activating said plurality of fluid ejection elements, said means for selectively activating coupled to said means for emitting photons and to said means for detecting photons.

56. The fluid dispensing system in accordance with claim 54, wherein said means for generating further comprises means for ejecting essentially a drop of said fluid, wherein said drop is in the range from about 5 femto-liters to about 750 pico-liters.

57. The fluid dispensing system in accordance with claim 54, further comprising:

means for containing said fluid disposed proximate to said means for generating an energy pulse; and

means for fluidically coupling a nozzle to said means for generating an energy impulse.

58. The fluid dispensing system in accordance with claim 54, further comprising:

means for storing information electrically coupled to said means for detecting photons; and

means for shifting a voltage signal from said means for detecting photons, said means for shifting electrically coupled to said means for generating an energy impulse.

59. The fluid dispensing system in accordance with claim 54, further comprising means for focusing photons emitted from said means for emitting photons.

60. The fluid dispensing system in accordance with claim 54, further comprising means for deviating photons emitted from said means for emitting photons.

61. The fluid dispensing system in accordance with claim 54, wherein said moveable carriage further comprises means for reciprocating said moveable carriage.

62. The fluid dispensing system in accordance with claim 54, wherein said moveable carriage further comprises means for translating said moveable carriage.

63. The fluid dispensing system in accordance with claim 54, wherein said moveable carriage further comprises means for in two dimensionally translating said moveable carriage.

64. A method of manufacturing a fluid dispensing system, comprising:
mounting a photon source on a moveable carriage;
creating an array of fluid ejectors disposed on a substrate;
creating an array of photodetectors on said substrate; and
coupling said array of photodetectors to said array of fluid ejectors;
wherein moving said photon source over at least a portion of said array of photodetectors, selectively illuminates said array of photodetectors, thereby selectively activating said fluid ejectors coupled to said illuminated photodetectors.

65. The method in accordance with claim 64, wherein creating an array of fluid ejectors further comprises creating an array of energy converting elements on said substrate, wherein activating an energy converting element ejects essentially a drop of said fluid in the range of from about 5 femto-liters to about 750 pico-liters.

66. The method in accordance with claim 64, further comprising:

forming a chamber layer over said substrate;

defining side walls of an array of fluid ejection chambers about said array of fluid ejectors, said side walls formed in said chamber layer;

creating a nozzle layer over said chamber layer; and

defining at least one nozzle in said nozzle layer fluidically coupled to at least one fluid ejector.

67. The method in accordance with claim 66, wherein creating a nozzle layer further comprises creating a micromolded nozzle layer having said at least one orifice formed therein.

68. The method in accordance with claim 66, wherein forming a chamber layer further comprises forming a micromolded chamber layer having said sidewalls of an array of fluid ejection chambers formed therein.

69. The method in accordance with claim 64, further comprising forming a photodetector on said substrate.

70. The method in accordance with claim 64, further comprising:

forming at least one fluid inlet channel in said substrate fluidically coupled to at least one fluid ejector of said array of fluid ejectors; and

forming a fluid distribution channel fluidically coupled to said at least one fluid inlet channel.

71. The method in accordance with claim 64, further comprising

creating at least one optical triggering circuit electrically coupled to at least one fluid ejector of said array of fluid ejectors and to at least one photodetector of said array of photodetectors.

72. The method in accordance with claim 71, wherein said creating at least one optical triggering circuit further comprises:

creating a memory device electrically coupled to at least one photodetector of said array of photodetectors; and

creating a voltage level shifter electrically coupled to said memory device and to at least one fluid ejector of said array of fluid ejectors.

73. The method in accordance with claim 64, further comprising mounting at least one focusing element between said array of photodetectors and said photon source.

74. The method in accordance with claim 73, further comprising forming at least one focusing element of said array of focusing element.

75. The method in accordance with claim 64, further comprising mounting at least one photon beam deviator between said array of photodetectors and said photon source.

76. The method in accordance with claim 75, further comprising forming said at least one photon beam deviator.

77. The method in accordance with claim 64, wherein creating said array of fluid ejectors further comprises creating an m x n array of fluid ejectors; wherein creating said array of photodetectors further comprises creating an m x n array of photodetectors, wherein each photodector is coupled to a fluid ejector of said array of fluid ejectors; and wherein mounting said photon source further comprises mounting a photon source having a j x k array of photon emitters wherein j is less than or equal to m, and wherein k is less than or equal to n.

78. The method in accordance with claim 48, wherein mounting said photon source having said j x k array of photon emitters further comprises mounting a photon source having a j x k array of photon emitters wherein j is less than m and m is an integral multiple of j, and wherein k is less than n and n is an integral multiple of k.

79. The method in accordance with claim 64, wherein creating said array of fluid ejectors further comprises creating an m x n array of fluid ejectors; wherein creating said array of photodetectors further comprises creating an m x n array of photodetectors, wherein each photodector is coupled to a fluid ejector of said array of fluid ejectors; and wherein mounting said photon source further comprises mounting a photon source having a j x n array of photon emitters wherein j is less than m and m is an integral multiple of j.

80. A method of using a dispensing system, comprising:

moving a photon source mounted in a moveable carriage over at least a portion of an array of photodetectors;

activating said photon source to selectively emit photons photonically couplable to a predetermined photodetector of said array of photodetectors;

photo-generating a fluid ejector activation signal in said predetermined photodetector;

coupling said activation signal to a fluid ejector of an array of fluid ejectors; and

activating said fluid ejector to eject a fluid.

81. The method in accordance with the method of claim 80, wherein activating said fluid ejector further comprises activating an energy converting element to eject essentially a drop of said fluid.

82. The method in accordance with the method of claim 81, wherein activating an energy converting element further comprises ejecting essentially a drop of said fluid having a volume in the range of from about 5 femto-liters to about 750 pico-liters.

83. The method in accordance with the method of claim 81, wherein said activating an energy converting element further comprises activating a thermal resistor, wherein said thermal resistor heats a component in said fluid above said components boiling point causing vaporization of said fluid component generating an expanding bubble ejecting essentially a drop of said fluid.

84. The method in accordance with the method of claim 80, wherein photo-generating said fluid ejector activation signal further comprises amplifying a photodetector signal.

85. The method in accordance with the method of claim 84, wherein amplifying said photodetector signal further comprises shifting a voltage level of said photodetector signal.

86. The method in accordance with the method of claim 80, wherein activating said fluid ejector further comprises activating said fluid ejector to eject a fluid having a dissolved or dispersed solid in at least one component of said fluid.

87. The method in accordance with the method of claim 80, wherein activating said photon source further comprises selectively activating an j x k array of photon emitters; wherein photo-generating said fluid ejector activation signal further comprises selectively generating an m x n array of fluid ejector activation signals; and wherein activating said fluid ejector further comprises selectively activating an m x n array of fluid ejectors, wherein j is less than or equal to m and k is less than or equal to n.

88. A fluid dispensing system, comprising:

an array of fluid ejectors disposed on an substrate;

a photodetector electrically coupled to each fluid ejector of said array fluid of ejectors;

a moveable carriage having at least one photon source disposed on or in said carriage; and

a fluid ejector controller electrically coupled to said at least one photon source, wherein moving said at least one photon source across said array of fluid ejectors selectively couples said at least one photon source to a predetermined number of said photodetectors, wherein photons emitted from said at least one photon source interact with said predetermined number of said photodetectors generating activation signals activating a predetermined number of fluid ejectors to eject a fluid away from said fluid ejectors.

89. A method of using a dispensing system, comprising:

moving a photon source mounted in a moveable carriage over at least a portion of an array of photodetectors;

selectively illuminating photodetectors of said array of photodetectors;

selectively activating a fluid ejector coupled to said illuminated photodetector, thereby ejecting a fluid.

90. A fluid dispensing system, comprising:

a photon source disposed on or within a moveable carriage;

a fluid ejector array having a plurality of fluid ejection elements disposed on a substrate, each fluid ejection element having:

a fluid ejector,

a photodetector,

a memory device coupled to said photodetector, and

a voltage level shifter electrically coupled to said memory device and to said fluid ejector,

a focusing element disposed between said photon source and said

photodetector;

a drop firing controller coupled to said photon source and to said fluid ejector array, wherein moving said photon source over at least a portion of said fluid ejector array, said drop firing controller selectively illuminates said photodetectors, thereby selectively activating said fluid ejectors coupled to said illuminated photodetectors.

91. A method of manufacturing a fluid dispensing system, comprising:

mounting a photon source on a moveable carriage;

creating a fluid ejector array having a plurality of fluid ejection elements disposed on a substrate, each element including:

a fluid ejector,

a photodetector,

a memory device coupled to said photodetector, and

a voltage level shifter coupled to said memory device and to said fluid ejector,

creating a focusing element disposed between said photon source and said photodetectors;

creating a drop firing controller coupled to said photon source and to said fluid ejector array, wherein moving said photon source over said fluid ejector array, said drop firing controller selectively illuminates said photodetectors, thereby selectively activating said fluid ejectors coupled to said illuminated photodetectors.

92. A method of using a dispensing system, comprising:

moving a photon source mounted in a moveable carriage over at least a portion of an array of photodetectors;

selectively activating said photon source to emit photons while moving over said array of photodetectors

focusing said emitted photons on predetermined photodetectors of said array of photodetectors;

photo-generating fluid ejector activation signals in said predetermined photodetectors;

amplifying said fluid ejector activation signals;

coupling said amplified activation signals to fluid ejectors of an array of fluid ejectors; and

activating said fluid ejectors to eject a fluid.